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Development of a risk-based large group revision quiz for first year undergraduates

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Abstract

We describe the development and delivery of a revision quiz suitable for a large group of students.

The design of the quiz involves students working in small groups and incorporates the use of audience response devices thus actively engaging all students in the activity. It also incorporates an element of risk to further engage and focus the students' attention and learning. The quiz has been adapted for use with different groups of students and is very well received by students in evaluation surveys.

Overview

We have experienced increasing demand from undergraduate students, particularly those in the early years of study, to be able to access more 'test-style' material to help with revision, as well as guidance on how to approach their university assessments. This demand may be driven by previous experience of preparation for school tests via the use of past exam papers, coupled with concerns over the unfamiliarity of university assessments. With increased use of multiple choice questions (MCQs) in university assessments in the biomedical sciences, especially in first year, there is often reluctance from course organisers to make more questions available to students as good MCQs are challenging to write and are therefore kept for use in summative tests (4).

Throughout their studies, students need to be able to develop confidence in their knowledge and their ability to answer unfamiliar questions as well as apply their knowledge to new questions. Case and Swanson (4) emphasise that the purpose of testing is to communicate to students what material is important, it also motivates them to study and can help identify areas of deficiency. There are many ways outside of the 'end of course' summative assessments in which to achieve this such as via social media (12) and online question platforms such as Peerwise (10) and Quizlet (5). Many of these platforms however see the student working alone or in digital communities with fellow students and

do not enable real-time academic input to the process of attempting unfamiliar questions. An opportunity for students to attempt test-style questions in a formative setting with immediate academic feedback allows students to not only gain confidence in tackling the question formats they will encounter in tests but also to allow them to learn from mistakes and avoid repeating these in summative assessments (7).

Strategies and practise in answering MCQs on course material can be developed through tutorial-style small group teaching for which there is strong evidence for the effectiveness of this style of learning (9). However, there is often variability in experience between tutorial groups with different tutor and student dynamics which highlight the complex challenges which come with small group teaching when compared to large group teaching (11). Small group teaching is also labour intensive and requires considerable staff time and the physical space to deliver such teaching. A solution to this is whole class group tutorials which allow all students to receive the same teaching experience and are less staff intensive. This style of teaching has the potential of not engaging the whole cohort as effectively as in a small group setting, however team work between small group of students within a larger group can promote engagement of all students especially if an element of uncertain reward and gaming is built in to the activities (8).

It is well documented that introducing elements of student-led learning into courses improves student outcomes (1). A means for engaging students and allowing them to determine the outcome of the teaching in a large class setting can be achieved by using audience response devices via e-voting (clickers). E-voting has been demonstrated to improve student engagement and their use can be adapted to encourage collaborative working (3). This is particularly the case if the students are influencing the outcome of a session by choosing the material delivered using e-voting. The use of clickers also allows students to judge their performance relative to their peers anonymously and for teachers to identify and immediately clarify misconceptions which, using other forms of e-learning is often lost (3).

In addition to the choice element, in order to maintain student engagement, it has been shown that introducing some 'risk' into answering questions can help to reinforce learning (8). A session where students work in teams allows an element of risk or jeopardy to be included into the session that is perhaps less threatening as the risk is shared within the teams (2).

We describe the development and delivery of a whole class revision quiz tutorial to three cohorts of first year students (Dentistry, Veterinary and BSc Physiological Science students) that includes elements of e-voting and risk. Although content specific to these disciplines was used, this format of teaching could be used for any knowledge-based course that is assessed via MCQs. Students choose their own teams and use clickers to help shape the delivery of the quiz by voting on the difficulty of question rounds answered. The session was introduced to engage students in the style of a 'pub quiz' but had an additional element of jeopardy or risk with students judging their confidence in their own team's answers which then reflected the overall marks awarded (jeopardy score).

Methods

The session outlined below has been used with three different cohorts of first year undergraduate students taking basic biomedical science/healthcare degrees over the past three years; the format worked the same for all cohorts, but the questions used were adapted accordingly to suit course content.

All sessions were delivered in a standard lecture theatre in a timetabled session towards the end of the academic year and prior to the start of the revision period for the end of course assessments. A two-hour slot was booked to ensure adequate time for delivery of the quiz and for any follow up of misconceptions at the end of the session.

The session was run by one member of staff (usually the course organiser or someone equally familiar with content across the course) using a pre-developed PowerPoint presentation. Students attended

the session with no prior knowledge of what would be delivered or any expectation of preparation and were able to sit wherever they chose. Students organised themselves into teams and each team was assigned an audience response device or 'clicker' and asked to nominate a team captain to contribute to the e-voting for the interactive aspects of the session.

With the time available, the session was run with three rounds of five questions per round categorised as either easy, medium, hard or pot-luck (random) as judged from the previous performance of the questions in summative assessments. There was also an additional 'picture round' of five questions that focussed on the practical content of the course (Fig. 1). To encourage student engagement a small prize was obtained to award to the overall winning team at the end of the session.

Starting the session

On arrival, the purpose of the session was outlined to the students by the academic lead. Students were asked to organise themselves into teams of a maximum of five students per team. Depending on class size (ranging from 70 – 200 students), this equated to between 14 and 40 teams participating in the quiz. Each team was given a clicker and a printed blank score sheet on which to note their answers and scores, this also featured the five picture round questions on the reverse (Fig. 1).

The structure of the session was explained by the academic lead (Fig. 2) including the application of the jeopardy score (explained further below). Each team then nominated a team captain to vote for the rounds of questions to be used in the quiz using TurningPoint™ software and e-voting clickers. This e-voting system allows students' responses to be collected anonymously and displayed to the whole class. The team captains voted on which three difficulty categories of questions would form the rounds of the quiz for all teams; these were picked from four categories titled: easy, medium, hard and pot-luck (random). The highest voted difficulty categories were used to generate the quiz.

The quiz

Five best of 5 multiple choice questions per difficulty round, as voted for as above, were presented in turn by the academic lead with the use of PowerPoint to the whole class and the teams discussed and entered their chosen answers on the score sheet. A paper-based score sheet was used to record the teams answers and jeopardy scores at this stage to allow teams to then swap sheets for marking by another team at the end of the quiz (Fig. 2). This is the same approach used in a traditional British 'pub quiz' on which the format of this quiz is based. Evoting on the answers was only used during the marking of the score sheets at the end of the quiz to allow answers to be displayed to the rest of the group for further discussion.

All questions complied with good practise in writing this style of question including adhering to the cover-up test i.e. ensuring the question could be answered even without the potential answers being viewed and ensuring that all distractors were homogenous i.e. all potential answers having the same theme such as hormones, cells, drugs etc. (4). Question topics included all the key subjects taught in that course and included a mix of pure knowledge recall and more problem-based/data-interpretation style questions. At this stage, no e-voting was required.

In addition to each chosen answer, teams had to decide on a 'jeopardy score' per question based on how confident they were with their answer. Team members had to decide if they were: very confident, fairly confident or not confident that their answer was correct. The jeopardy score would influence their mark for that question with those that were very confident in their answer scoring highly (4 marks) if they were correct but receiving a negative mark (-2 marks) if they were incorrect. Likewise, teams that were not confident in their answers would score a positive but lower mark (1 mark) for correct answers but were not penalised for incorrect answers (0 marks). Those that were fairly confident in their answer scored 2 marks if correct and were penalised -1 mark if incorrect (Fig. 3). For example, a team rating all 5 answers in a round as very confident and getting them all correct would be rewarded with a score of 20 but getting them all incorrect would score -10. A team rating all 5 answers in a round as not confident and getting them all correct would score 5 but getting them all

incorrect would score 0. Adequate time was given per question to allow students in each team to decide on their chosen answer and to agree on a jeopardy score per question before moving on to the next question in the round.

When all rounds were complete the teams were given time to complete the picture round (Fig. 1) before swapping score sheets to mark another team's answers. The picture round included questions such as identifying the correct set up of equipment (e.g. the correct positioning of ECG electrodes) and extracting information from a figure or graph and calculating a value (e.g. calculating cardiac output from a data monitor displaying heart rate and stroke volume). The picture round was not included in the jeopardy scoring and therefore had a maximum potential score of 5.

Marking

Completed score sheets were randomly swapped with another team and the quiz questions were displayed to the class again in turn in the order in which they had been delivered during the quiz, this time using the TurningPoint™ software. Each team captain was instructed to vote for the answer given by the team whose score sheet they were marking using their team clicker (Fig. 2)

The percentage of teams giving each answer was revealed on each slide along with the correct answer (Fig. 4) and students marked the score sheet in front of them. The mark awarded for each question took into account the jeopardy score as outlined above. Each correct answer was then explained, and any misconceptions were clarified by the academic lead.

The final team scores, including the jeopardy scores and those of the final picture round, were calculated by the marking teams and score sheets collected in. The winning team was verified by the academic lead before score sheets were returned to the original teams. The team captain reported their team's score in a final slide using e-voting to enable each team to see where they came in the rankings. A small prize, such as a bag of sweets, was then awarded to the members of the winning team.

Evaluation

Initial observations from academic leads within these sessions are that it was apparent that the students were engaged and there was good discussion within the teams about the answer for each question. When a new question was revealed, there was always a short period of silence as the teams read and digested the question, then a noisier period as the students discussed the answer within the teams. There has been no evidence of any students being left out of their team's discussion or any students being too dominant within a team. The jeopardy aspect of the scoring forced students to think carefully about their answer before committing and highlighted areas to earmark for further study as well as providing an opportunity for misconceptions to be explained.

At a later date, students were asked to evaluate the revision quiz as part of the course evaluation. This was carried out by the students answering questions on the course content with their individual clickers. Evaluation by the different cohorts of students was consistent. Typically 85% of students agreed or strongly agreed that the quiz was a useful revision exercise and 67% agreed or strongly agreed that deciding on a jeopardy score in their team helped to identify areas of the course that knowledge was strong or weak.

Suggestions for adaptations and extensions

For the purposes of the session outlined here, the revision quiz was a one-off informal and fun way to engage first year undergraduate students in formative assessment of basic biomedical science principles in a group-style setting. However, aspects of this session could be used in different ways and extended for a variety of purposes.

The style of the session could be used for any discipline that uses multiple choice style questions and instead of a one-off end of course session could be used regularly as 'pop quizzes'. If used in this way,

the jeopardy element could be introduced from the beginning or brought in later in a course when educators might want to start challenging students to consider the answers they choose. If used regularly, course organisers might want to introduce a summative element to the marks, especially if students remained in consistent teams although the relative contribution of these marks to a course must always be small due to the group nature of the work. Even if used in a formative manner, for the purposes of monitoring student attendance and progress, score sheets could be taken in after the session and verified by staff if necessary.

Other question styles may also work in this format of quiz such as calculation-style or specimen identification questions. The number of questions per round and the number of rounds per quiz are entirely at the discretion of the academic lead based on the time and questions available. The authors found that a two-hour session enabled four rounds of five questions to be delivered without rushing and with time for feedback on each question during the scoring at the end of the session. Students could be encouraged to contribute to this feedback with each team having to provide an explanation to a question they got correct to the rest of the cohort depending on class size. Often it is also useful to highlight questions students have got incorrect and ask a willing volunteer to explain their logic to help correct misconceptions or miscalculations. This would further engage the students in the whole process. The use of clickers is also optional; there are currently several different options on the market with varying effectiveness including the use of smart phones and software such as Poll Everywhere (6). The quiz could also be effectively delivered with simply a show of hands to vote for the question rounds and report the teams' answers although this removes the anonymity of students' contribution.

Obtaining questions to use in a quiz such as this can be a timely exercise when first starting out. If no such formative questions currently exist, the academic lead could ask each lecturer on the course to contribute one or more revision question for the quiz per theme. Questions could also be obtained or adapted from previous summative papers that are no longer being used or from other course material that students are less likely to engage with such as voluntary online quizzes. The format of the quiz

may also lead to the development of questions that would otherwise be difficult to embed in a paper-based exam produced on a mass scale such as questions that use high quality colour images. Any non-used rounds of questions could then be used as supplementary revision material online if required.

Conclusion

When replacing small group teaching for larger group sessions, student engagement is key. The use of e-voting allowed students to be involved in the session from the start by influencing the question rounds to be used. Although only 3 of the 4 question rounds are used in each session different rounds are picked each time the quiz is run so there are no redundant questions. In addition, the use of the e-voting software allowed the answers given by each team to be displayed and allowed students to compare their performance to those of the other teams. Any incorrect answers could be immediately clarified and explained by the academic lead, further aiding students' revision.

The jeopardy score introduced a further competitive element to the quiz to reinforce learning and help students identify areas for revision. This was particularly identified by the students as a technique that helped them identify areas of their knowledge where they may need to focus their revision in their feedback of the session.

Overall the quiz was well received by the students with high levels of engagement and provided an effective way to provide a revision resource to large numbers of students. Whilst timely to put together such a resource in the first instance, our practice has shown that it can be used annually and across multiple courses with only minor adaptations. The format of this activity is easily adaptable for use in many disciplines particularly those where multiple choice questions are used in assessments to provide students with further examination style practise and feedback.

Fig. 1. Picture round used in quiz.

Fig. 2. Schematic illustrating plan of quiz session.

Fig. 3. Jeopardy scores.

Fig. 4. Example question slide with e-voting results.

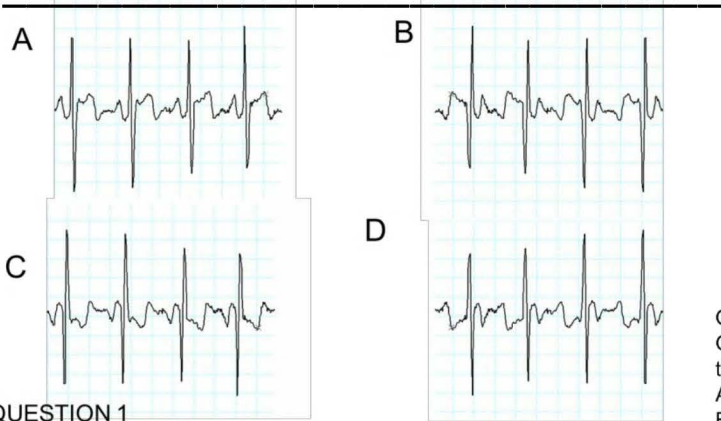
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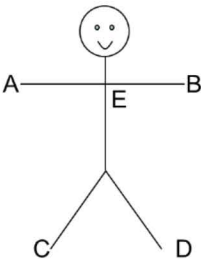
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Group members: _____

PICTURE ROUND



QUESTION 1
Which of the above traces would best represent a lead II ECG recording in a healthy Adult?
A. A
B. B
C. C
D. D
E. All of the above

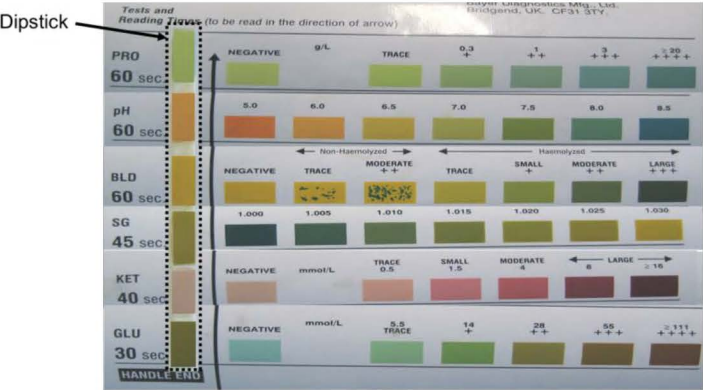


QUESTION 2
On the person above, where would you attach the positive electrode to record a lead II ECG?
A. A
B. B
C. C
D. D
E. E

Question 3



Which of the following respiratory parameters can be measured using this piece of equipment?
A. Dead space
B. Tidal volume
C. Residual volume
D. Respiratory rate
E. Forced vital capacity



Question 4
Above is a urine dipstick that has been used to test the urine of a subject pictured alongside the reference chart. Which of the following physiological/pathophysiological conditions would give this dipstick profile? The subject is
A. is a healthy individual
B. has untreated diabetes mellitus
C. has untreated diabetes insipidus
D. has glomerular damage
E. has intravascular damage

Question 5

HR	MAP	C.O.
71	78	5.9
SpO2	Hct	Isch. idx.
99	42.30	1.74
ABP	PAP	CVP
116/51	28/13	9
Left Vol.	Right Vol.	Spont.VT
1076	1096	737
PACO2	PAO2	Spont.RR
42.1	117.0	13
Alv. N2O	Alv. Iso.	Alv. Sevo.
0.0	0.0	0.0
Alv. Halo.		Alv. Enf.
0.0		0.0
PaCO2	pH	PaO2
40.6	7.43	111.8
PvCO2		PvO2
44.7		44.9
TBody	Weight	TBlood
36.5	70.0	37.0

Pictured is a display of physiological parameters obtained from the human patient simulator. From these readings calculate the respiratory minute volume.
A. 56.7ml
B. 1453ml
C. 9.58l
D. 56.7l
E. 14.53l

Set Up

- Students organize themselves in teams of up to 5 per team
- Each team is given a printed blank score sheet including the picture round on the reverse
- Students nominate a team captain to vote using evoting to chose the difficulty categories of question rounds to be used in quiz
- Three rounds are chosen to make up the quiz from: Easy, Medium, Difficult and Pot luck categories

The Quiz

- Five questions making up each round are displayed in turn using Powerpoint to all teams
- Teams decide on their answer and jeopardy score
- Answers and jeopardy scores are recorded on the printed score sheet
- Teams are given time to complete the picture round and record answers on the printed score sheet

Scoring

- Teams swap printed score sheets
- Questions are displayed again in turn via TurningPoint evoting software
- Team captains use a clicker to indicate the answer on the printed score sheet they are marking
- Correct answers are revealed in turn and any misconceptions explained
- Teams score questions on printed score sheet to include the jeopardy score
- Score sheets are collected in and a small prize given to the winning team

Jeopardy- danger of loss, harm, or failure

Jeopardy mark

1 = not confident

2 = fairly confident

3 = very confident

INCORRECT

CORRECT

Jeopardy mark

3

2

1

1

2

3

Jeopardy score

-2

-1

0

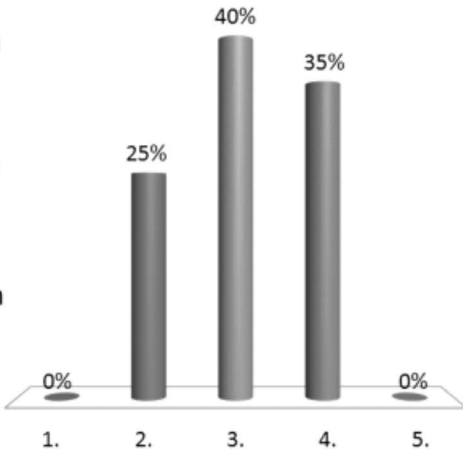
1

2

4

Q1. What effect does aldosterone have in the kidney?

- A. Increased water permeability in the collecting duct
- B. Increased secretion of sodium in the distal tubule
- C. Increased reabsorption of sodium in the proximal tubule
- ☒ D. Increased reabsorption of sodium in the distal tubule
- E. Increased secretion of calcium in the distal tubule



INCORRECT

CORRECT

3	2	1	1	2	3
-2	-1	0	1	2	4